NASA TECH BRIEF

Low Level Accelerometer Test Methods Are Investigated

The problems associated with testing accelerometers to an accuracy where the standard error is less than 10^{-8} g are centered around the elimination of uncertainties in the acceleration input to the accelerometer. Since absolute gravity can be measured only to approximately 10^{-6} g, the uncertainty in the earth's gravity field is a limiting factor. By placing a test rig in free fall, the uncertainty in the earth's gravity field can be eliminated.

Two basic methods of achieving a free-fall condition are: (1) the use of an airplane flying a parabolic arc, and (2) the use of a satellite. With the airplane a maximum testing time of 30 seconds is available and testing between 10^{-4} and 10^{-6} g input is possible with a precision centrifuge. With the satellite, testing time is essentially unlimited. For both satellite and airplane testing, the limiting factor is the accuracy with which angular velocity of the centrifuge can be measured.

To determine in detail the tests that should be performed on an instrument, the environment in which it will function should be clearly defined. Such a breakdown should include pressure, temperature, and voltage levels, as well as the acceleration level. One possible breakdown is:

(1) Boost guidance
(2) Midcourse navigation
(3) Reentry guidance
(4) Terrestrial or planetary navigation

Each area calls for a different level of accelerometer input. By defining the levels of acceleration that will be experienced, the required test environment can be defined.

In addition to the problem of determining the input field, there exist problems in the accuracy of the test instrumentation. These problems can be broken down into (1) orientation of the accelerometer, (2) measurement of accelerometer output, and (3) measurement of other test inputs such as temperature, pressure, and excitation voltages.

Note:

Further information concerning these test methods is given in "Low Level Accelerometer Test Methods," by H. S. Plourde and Dr. R. H. Nelson, Jr., Report No. E-578, 30 June 1965. Inquiries may also be directed to:

Technology Utilization Officer
Marshall Space Flight Center
Huntsville, Alabama 35812
Reference: B66-10510

Patent status:

Inquiries about obtaining rights for the commercial use of this invention may be made to NASA, Code GP, Washington, D.C. 20546.

Source: H. S. Plourde and Dr. R. H. Nelson, Jr.
of Dynamics Research Corporation
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